

## REMARKS

In accordance with the foregoing, claims 1, 5 and 11 are amended. Claims 1-16 are pending and under consideration. Reconsideration is requested.

### Entry Of Amendment

Applicants submit the amendments herein present no new matter and no new issues are being raised. As set forth in 37 C.F.R. §1.116:

After a final rejection or other final action (§ 1.113) in an application . . . but before or on the same date of filing an appeal (§ 41.31 or § 41.61 of this title): . . . An amendment presenting rejected claims in better form for consideration on appeal may be admitted.

Applicants submit that the claim amendments presented herein remove issues for appeal and will reduce the burden on the Examiner, the Board of Patent Appeals and Interferences and the Applicants during appeal.

Thus, the Examiner is respectfully requested to enter the claim amendments.

### Page 2: Objection to claims 1, 5, and 11

On page 2 of the Office Action, the Examiner objects to claims 1, 5, and 11 because of informalities.

Claims 1, 5, and 11 are amended herein to correct the informalities. Thus, withdrawal of the objection is requested.

### Pages 3-6: Rejection of claims 1-10 and 16 under 35 U.S.C. §103(a)

In item 4 of the Office Action, the Examiner rejects claims 1-10 and 16 under 35 U.S.C. §103(a) as being unpatentable over Abe (U.S. Pub. 2003/0136577). (Action at pages 3-6).

The rejections are traversed. Independent claim 1, for example, recites a semiconductor device substrate comprised of a core substrate having, on both main surfaces of which, respective interconnect patterns extending through resin layers, wherein: "the core substrate being of a material having a heat expansion coefficient of 4.0 to 10.6 ppm/<sup>0</sup>C, the heat expansion coefficient closer to that of a semiconductor chip than the respective heat expansion coefficients of the resin layers and the interconnect patterns, and a resin layer, forming an outermost layer of the semiconductor device substrate on each of the main surfaces thereof, of a material having at least one of a higher strength and a higher elongation than a resin material used for inner resin layers of the semiconductor device substrate and preventing cracking and deformation, of the semiconductor device substrate due to thermal stress occurring between two or more of the core substrate, the inner resin layers, and the interconnect patterns in the

semiconductor device substrate, an outermost interconnect pattern of the semiconductor device substrate is coated by a resin layer forming an outermost layer of the semiconductor device substrate, and the outermost interconnect pattern having a land exposed through the outermost layer formed of the resin layer," (emphasis added). Independent claims 5, 9, and 15 have similar recitations.

Applicants submit that that features recited by each of the independent claims are not taught nor suggested by Abe. By contrast with the recitation of claim 1, for example, Abe merely discloses various materials used in a circuit board, but does not teach nor suggest, for example, a resin having a high strength and elongation used as a outermost resin layer. (See, for example, Table 1). Further, Abe teaches:

[C]arbon fibers arranged in the core layer include . . . carbon fiber groups which are arranged in different direction to intersect each other, whereby a thermal expansion coefficient and strength of the core layer can be adjusted for arrangement directions of the first and the second carbon fiber groups by arranged amounts and cross angles of the first and the second carbon fiber groups. The thermal expansion coefficient and strength of the circuit board can be adjusted corresponding to electronic parts to be mounted.

(See, for example, paragraph [0019]).

That is, Abe teaches an adjustment of properties of a core layer by using different arrangements of carbon fibers, and not by using an adjustment of resins. Further, Abe teaches:

[T]he thermal expansion coefficients of invar, covar, alloys, such as silicon steel, and a clad material, such as CIC, are substantially the same as the thermal expansion coefficient of silicon. However, they have large specific gravities and add weights unsuitably to be used in the circuit boards, which are processed with the large-sized cores included. Their Young's moduli of elasticity are not high, and large core substrate(s) undesirably have bowing and waves, which causes troubles in the build-up process and in mounting semiconductor elements.

(Emphasis added, see, for example, paragraph [0010]).

That is, Abe teaches that a core, as recited by claim 1, for example, including a "substrate being of a material having a heat expansion coefficient closer to that of a semiconductor chip" is unsuitable. Abe teaches, instead, a core substrate that is a fiber reinforced metal, and different compositions and rearrangements of a core by rearranging carbon fibers, for example.

Further, Abe does not teach that a material's characteristics of strength and/or elongation are different respectively for an outermost resin layer and inner resin layer. The Action concedes that Abe does not teach:

[M]aterial for the core substrate is selected so that it is closer to that of a semiconductor chip than the respective heat expansion coefficients of the (third) main resin layers . . . and the interconnect patterns . . . core substrate 10 having respective interconnects patterns . . . extends through the resin layers.

(See, for example, Action at page 4, lines 9 - 12).

However, the Examiner asserts it would have been obvious:

[T]o an artisan for optimization and experimentation to select the available materials in Table 1 for . . . preventing cracking, deformation, . . . arising in the substrate due to the thermal stress occurring between the core substrate and the inner resin layers in the substrate and interconnect patterns in the substrate . . . resin layers 14, 22, 26, 30 (fig. 1) may be selected among the disclosed group of materials . . . to provide the outermost layer with the higher strength and elongation than the inner layer because the results are predictable. . . when there is motivation . . . and . . . a finite number of identified, predictable solutions. . . reason to pursue the known options . . . embodiments/materials demonstrate that there were a finite number of known techniques/materials for making a circuit board with high rigidity and reliability. . . reason to try these materials, including core substrate material with a heat expansion of 4-10 ppm/°C, with a reasonable expectation of success.

(Emphasis added, See, for example, Action at page 4, lines 9 -12).

Further, the Examiner asserts:

With respect to applicants' allegation that Abe does not explicitly teach a resin with a high strength and elongation used in the outermost layer. . . examiner notes that there are a finite number of materials listed in Table 1 of Abe for the resin layers . . . within a general skill of a worker to select the known material.

(See, for example, Action at page 7, lines 4-7).

Applicants submit that many of the Examiner's assertions, are an unsupported taking of Official Notice, can not be relied on in support of a finding *prima facie* obviousness. As set forth in MPEP §2144.03 Reliance on Common Knowledge in the Art or "Well Known:

It would not be appropriate for the examiner to take official notice of facts without citing a prior art reference where the facts asserted to be well known are not capable of instant and unquestionable demonstration as being well-known. The examiner must provide specific factual findings predicated on sound technical and scientific reasoning to support his or her conclusion of common knowledge. . . . The applicant should be presented with the explicit basis on which the examiner regards the matter as subject to official notice \*\*>so as to adequately traverse the rejection< in the next reply after the Office action in which the common knowledge statement was made.

As an example, Applicants submit that the Examiner's is taking official notice of facts by asserting that one of ordinary skill in the art may select from a list of materials in a table, e.g., Table 1 disclosed by Abe including only thermal expansion coefficients of fiber materials and metal materials, and select appropriate material(s) for "the advantage of preventing and

cracking, deformation . . . arising in the substrate," (emphasis added).

As another example, Applicants submit the Examiner is taking official notice of facts by asserting that one of ordinary skill in the art may make a selection, from a table that only lists an overall range of thermal expansion coefficients for polyimide resins, as to which thermal expansion coefficients correlate with those resin layers giving an outermost layer having a higher strength and elongation.

Thus, Applicants submit the Examiner is taking official notice of facts in his statement that one of ordinary skill in the art may determine strength and elongation of a resin based on a listed thermal expansion coefficient.

Further, Applicants submit that the Examiner's statement in support of the rejection that a list of materials merely giving ranges of thermal coefficients results in "a finite number of known techniques/materials for making a circuit board with high rigidity and reliability," (emphasis added) is not supported. Applicants submit, rather, that such a relationship of material identification and circuit board manufacture with "high rigidity and reliability" is not "capable of instant and unquestionable demonstration as being well-known."

The Examiner has not supported the rejection with "specific factual findings predicated on sound technical and scientific reasoning" as required. Further, if such relationships and statements are based on the Examiner's own personal knowledge, the Examiner has not provided an affidavit, as required. (See, for example, as required by 37 CFR § 1.104(d)(2)).

\* \* \*

Claims 2-4, 6-8, and 10 depend respectively from independent claims 1, 5, and 9 and inherit those patentably distinguishing recitations and accordingly are likewise submitted, for the same reasons, to be allowable.

## **Conclusion**

Since features recited by independent claims 1, 5, 9, and 16 (and dependent claims 2-4, 6-8, and 10) are not taught by an *arguendo* combination of the art of record, the rejection should be withdrawn and claims 1-10 and 16 allowed.

## **Item 5: Rejection of claims 11-15 under 35 U.S.C. §103(a)**

In item 5 of the Office Action, the Examiner rejects claims 11-15 under 35 U.S.C. §103(a) as being unpatentable over Abe in view of Nair (U.S. Pub. 2004/0095734). (Action at page 6).

The rejection is traversed. Independent claim 11, for example, recites a semiconductor device substrate comprised of a core substrate having, on both main surfaces of which,

respective interconnect patterns extending through resin layers, wherein: "a core substrate being of a metal alloy having a heat expansion coefficient of 4.0 to 10.6 ppm/°C, the heat expansion coefficient closer to that of a semiconductor chip than the respective heat expansion coefficients of the resin layers and the interconnect patterns, and a resin layer, forming an outermost layer of the semiconductor device substrate on each of the main surfaces thereof, of a material having at least one of a higher strength and a higher elongation than a resin material used for inner resin layers of the semiconductor device substrate and preventing cracking and deformation, of the semiconductor device substrate due to thermal stress occurring between two or more of the core substrate, the inner resin layers, and the interconnect patterns in the semiconductor device substrate, an outermost interconnect pattern of the semiconductor device substrate is coated by the resin layer forming the outermost layer of the semiconductor device substrate, and the outermost interconnect pattern has a land exposed through the outermost layer formed of the resin layer," (emphasis added). Independent claims 13 and 14 have similar recitations.

As argued in traversing the rejection of claims 1-10 above, Applicants submit that:

- Abe does not teach nor suggest a core substrate being of a metal alloy having a heat expansion coefficient of 4.0 to 10.6 ppm/°C, and
- Abe does not teach nor suggest an outermost interconnect pattern of the semiconductor device substrate is coated by a resin layer forming an outermost layer of the semiconductor device substrate, and the outermost interconnect pattern has a land exposed through the outermost layer formed of the resin layer.

Applicants submit that the teachings of Nair do not overcome these deficiencies in the teachings of Abe. In addition, the Examiner asserts that since Nair teaches:

[A]n analogous device having a core substrate . . . made of an iron-nickel alloy . . . for providing a high capacitance substrate. . . it would have obvious . . . to [sic-modify] material of the core substrate of Abe with the iron nickel alloy material, as taught by Nair, for providing the advantage.

(See, Action at page 6, lines 11- 15).

But, Applicants further submit the Examiner's assertions are in error. Abe specifically discloses:

As shown in Table 1, the thermal expansion coefficients of the metal materials are larger than the thermal expansion coefficient 3.5 ppm/.degree. C. of silicon, but the thermal expansion coefficient of carbon is 0.2 ppm/.degree. C., which is smaller than that of silicon. The thermal expansion coefficient of SiC is substantially equal to that of silicon. . . . found that a composite material of the metal material and the fiber material is formed to thereby form the core substrate of a thermal expansion coefficient which is approximate to that of

silicon.

(Emphasis added, See, paragraph [0053]).

That is, since Abe teaches a core substrate needs to be a composite material since metal alloys have thermal coefficients of expansion larger than the thermal expansion coefficient of silicon, Applicants submit that one of ordinary skill in the art would not have modified Abe and Nair, in a manner as the Examiner suggests.

Further, Applicants submit that the Examiner's proposal to modify Abe with Nair is unreasonable since as set forth in MPEP §2143.01, a claimed combination cannot change the principle of operation of the primary reference or render the reference inoperable for its intended propose and that it is improper to combine references where the references teach away from their combination.

\* \* \*

The Examiner also asserts:

[A]pplicants allege that Abe teaches a metal alloy that has a thermal coefficient expansion larger than silicon. First, applicants' argument is flaw [sic] because applicants fail to particularly point out which material in Table 1 is the metal alloy taught by Abe. Second, the examiner uses Nair for the teaching of a metal alloy as claimed which cures Abe's deficiency.

(Emphasis added, See, for example, Action at page 7, lines 12-14).

Applicants submit that the Examiners comments regarding the Applicants traverse of the rejection of claims 11-15 in the previous Amendment filed June 13 2008 ("previous Amendment") are unfounded.

In the previous Amendment, Applicants traversed the rejection by also arguing that a proposed combination of Abe and Nair was unreasonable since Abe teaches a core substrate should be a composite material since metal alloys have thermal coefficients of expansion larger than the thermal expansion coefficient of silicon. (See, previous Amendment, page 11, line 35 - page 12, line 2). Applicants submit this argument is not flawed, as the Examiner asserts. Rather, Applicants submit that the Examiner's interpretation of Abe is in error.

\* \* \*

Claims 12 and 15 depend respectively from independent claims 11 and 14 and inherit those patentably distinguishing recitations and accordingly are likewise submitted, for the same reasons, to be allowable.

## Conclusion

Since features recited by independent claims 11, 13, and 14 (and dependent claims 12

and 15) are not taught by an *arguendo* combination of the art of record, the rejection should be withdrawn and claims 11-15 allowed.

### Conclusion

There being no further outstanding objections or rejections, it is submitted that the application is in condition for allowance. An early action to that effect is courteously solicited.

Finally, if there are any formal matters remaining after this response, the Examiner is requested to telephone the undersigned to attend to these matters.

Respectfully submitted,

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